CUSTOMERS AND COMMUNITY
Introduction

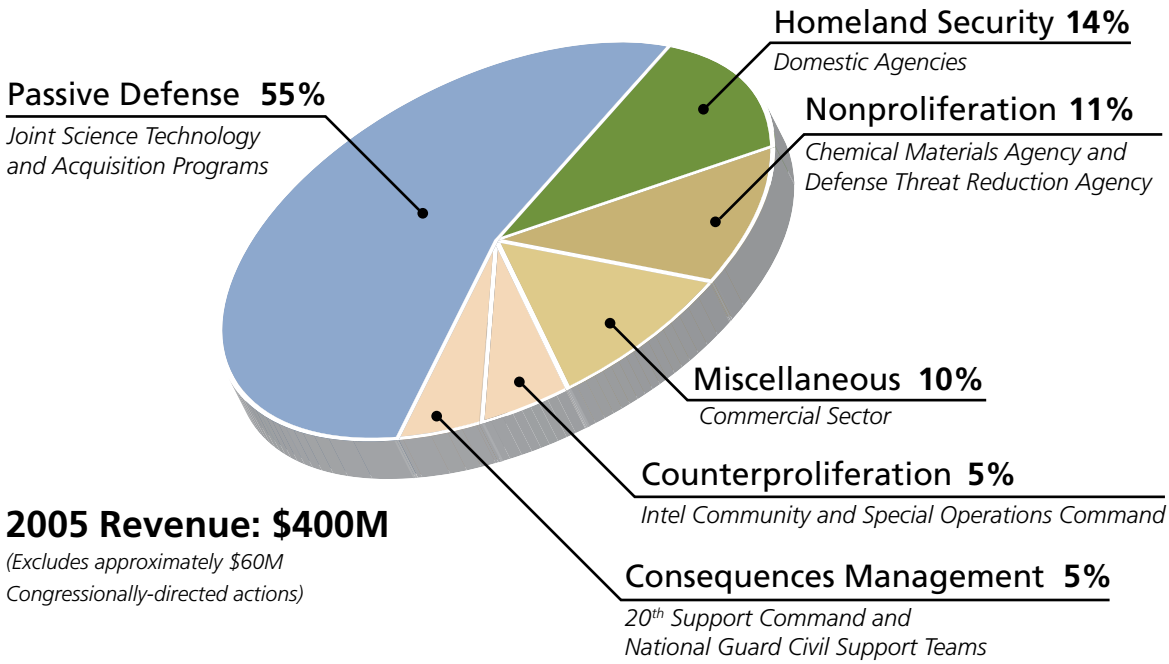
According to a survey of national security experts conducted in 2005 by Senator Richard Lugar, chairman of the Senate Foreign Relations Committee, the risk of an attack involving some form of weapons of mass destruction, such as chemical, biological, radiological or nuclear material, is extremely high. The survey suggests that the risk of such an event occurring in the next five years is as high as 50 percent.

Many government and commercial organizations are working to prevent, defend or respond to the use of chemical, biological, radiological or nuclear material. Some organizations are focused on collecting intelligence and developing programmatic strategy, others are dedicated to the acquisition of products and services and many participate by manufacturing specialized equipment and technologies. Edgewood Chemical Biological Center works with all of these organizations; applying its specialized understanding of chemical and biological materials and 90 years experience working with these materials to enable each organization to fulfill its mission. Through its support to the chemical and biological defense community at large, ECBC is fulfilling its own vision of being a national resource that is helping our nation address the threat of chemical and biological weapons.

Military strategists developed a layered approach to combating weapons of mass destruction, which includes nonproliferation, counterproliferation, passive defense and consequence management activities. In 2005, ECBC provided support to 95 customers who are executing missions in these areas, but the Center's largest contribution is in ensuring that our country has a strong passive defense program. As illustrated in the chart below, approximately 55 percent of ECBC's support was in passive defense—specifically providing detection, protection and decontamination science and technology for the warfighter.

In the area of passive defense, for the Defense Threat Reduction Agency Joint Science and Technology Office, ECBC conducted experimentation to obtain critically needed data on the behavior of chemical and biological agents in order to help answer fundamental science questions that underpin the development of equipment requirements, impact operations and refine tactics and techniques in the field. ECBC also conducted research and engineering studies that are resulting in the development of new detection, protection and decontamination technology. For the Joint Program Executive Officer for Chemical and Biological Defense, ECBC helped develop, mature and evaluate technologies to meet warfighter needs. ECBC also supported fielded items by ensuring that parts, repairs and sustainment support are in place for the life of the item.

In the area of nonproliferation, ECBC supported the Chemical Materials Agency's mission by providing expertise and manpower. ECBC's ability to safely handle agent-filled ton containers and chemical munitions has helped the Chemical Materials Agency achieve marked progress toward the destruction of US chemical weapons.



In support of consequence management, ECBC designed, built and delivered to the 20th Support Command two mobile laboratory suites uniquely suited for sampling and analyzing potential chemical and biological material in the field. ECBC scientists developed sampling and analysis methodology and trained 20th Support Command soldiers. ECBC also trained specialized military units from the 20th Support Command, Special Forces and National Guard Civil Support Teams in all facets of chemical and biological defense operations to combat weapons of mass destruction proliferation. Since 2000, ECBC has trained over 500 personnel each year on identification of chemical, biological or radiological materials, sample handling and management and decontamination techniques.

ECBC works with numerous federal agencies to strengthen homeland security. For the United States Postal Service in 2005, ECBC conducted extensive aerosol science studies in partnership with Northrop Grumman. These studies led to the redesign and delivery of new post office mail sorting equipment to post offices nationwide.

For the Department of Homeland Security, ECBC executed numerous research and development activities in 2005. Specifically, ECBC:

- Developed and demonstrated next-generation electrochemiluminescence-based biological agent assays using commercial platforms
- Designed and built two prototype All Hazard Receipt Facilities and associated protocols, which will allow public health and law enforcement personnel to safely prescreen unknown or potential threat materials
- Developed, evaluated and delivered simulation and decision tools and provided modeling and simulation support to programs responsible for planning, training, incident characterization, response and recovery
- Provided technical support to the Department of Homeland Security Center for Domestic Preparedness training facility in Anniston, Alabama

A brief discussion about ECBC's primary customers, their missions and how ECBC supports them in 2005 can be found on the next few pages of this Annual Report.

ECBC provides non-medical support to the chemical and biological defense community, developing new technologies that provide detection, protection and decontamination of chemical and biological materials. The Center works across the lifecycle—from conducting basic research to sustaining equipment once it is in use. In order to execute its mission, ECBC maintains nine fundamental capabilities:

- Chemistry and Bioscience of Chemical and Biological Warfare
- Inhalation Toxicology
- Aerosol Physics
- Filtration Sciences
- Agent Spectroscopy/Algorithm Development
- Chemical and Biological Testing and Evaluation
- Chemical and Biological Materiel Acquisition
- Agent Handling and Surety
- Chemical Munitions Field Operations

These capabilities form the backbone of ECBC's contribution to our nation's defense against chemical and biological threats.

Defense Threat Reduction Agency Joint Science and Technology Office

The Defense Threat Reduction Agency Joint Science and Technology Office is charged with managing the Department of Defense's chemical and biological defense science and technology program. The technology base program has three primary areas of emphasis—answering science questions, maintaining a robust technology base and transitioning technologies into the military acquisition system. ECBC provides significant support in all three of these mission areas.

A complete understanding of how chemical and biological agents impact human health and interact with the environment underpins equipment development, field operations and hazard assessments. A significant new finding in 2005 was the discovery that the nerve agent VX persists in concrete much longer than originally believed and can be reactivated to hazardous levels by rain. Similarly, scientists found that the nerve agent GD, an anticholinesterase agent, persists in soil and concrete and a light rain can reactivate the GD so that it outgases to the air at levels immediately dangerous to life and health. This work is described in more detail on page 16 of this Annual Report.

Transitioning technologies to the acquisition phase of the lifecycle is a critical piece of the Defense Threat Reduction Agency's science and technology mission. In support of this, ECBC transitioned two technologies in 2005 that will significantly address capability shortfall.

First, under Defense Technology Objective CB.52, ECBC addressed the need to conduct rapid chemical contamination reconnaissance. Scientists and engineers have improved the speed, accuracy and mobility of Raman spectroscopy as a technique for chemical agent reconnaissance following a chemical attack. This technology now allows for "non contact" surface contamination detection and identification via this laser-based approach.

In 2005, the Raman technology transitioned to the Chemical, Biological, Radiological, and

Defense Technology Objectives Supported by ECBC in 2005

CB.35 Standoff Biological Aerosol Detection

CB.37 Chemical and Biological Agent Water Monitor

CB.42 Environmental Fate of Agents

CB.44 Oxidative Decontamination Formulation

CB.50 Lightweight Integrated Chemical and Biological Detection

CB.51 Low-Level Operational Toxicology of Chemical Warfare Agent

CB.52 Surface Contamination Detection

CB.53 Wide-Area Aerial Reconnaissance

CB.61 Advanced Air Purification Model

Nuclear Unmanned Ground Reconnaissance Advanced Concept Technology Demonstration. Further transition for systems acquisition is programmed for 2008. ECBC scientists have developed the chemical agent "fingerprints" required to allow this technology to identify chemical agents while rejecting interferents. They have embedded these signatures into a detection algorithm that will allow automated, on-the-move, detection by warfighters conducting reconnaissance of potentially contaminated terrain.

Also transitioned in 2005 was the End-of-Life Service Indicator for the protective masks worn by warfighters. This device alerts service personnel of the remaining service life of their mask filters. Warfighters currently have no means of knowing how much residual life remains while in an operational environment, and this indicator will let troops avoid unnecessary filter changes in the field.

ECBC is developing a plan to transition the technology into the new Joint Service General Purpose Mask in 2007.

In 2005, ECBC helped the Chemical Biological Defense Program maintain a robust technology base in two ways. First, ECBC conducted research and development in the three chemical and biological defense non-medical commodity areas of detection, protection and decontamination—achieving technical advances in all areas. Second, ECBC developed and strengthened partnerships with other government laboratories, international allies, academia and the private sector to ensure that the technology base supporting chemical and biological defense is both broad and deep. Defense Technology Objectives in support of specific commodity area programs are listed in the chart on this page. Related discussions about ECBC's private sector partnerships can be found on page 13.

Joint Program Executive Office for Chemical and Biological Defense

The Joint Program Executive Office for Chemical and Biological Defense is the organization responsible for acquisition of chemical, biological, nuclear and radiological medical and non-medical defense materiel for all military services. ECBC actively supports this critical mission by supplying technology, scientific analyses, engineering and specialized personnel support.

Of the 51 Programs of Record managed by the Joint Program Executive Officer, ECBC provided either direct technology development support or matrixed acquisition-qualified personnel in support of 31 of those programs. These trained personnel serve as functional and commodity area experts. In 2005, ECBC provided approximately 225 matrixed staff members to the Joint Program Executive Officer's organization. Many of these personnel participated in the early stages of a specific technology's development and are following the technology as it enters production and fielding phases, providing unmatched technical support to accomplish a smooth transition from materiel development to field sustainment. ECBC engineers and logisticians participated in the handoff of new equipment to the warfighter and trained users in proper operation, often becoming the "face to the field" for the remainder of that equipment's lifecycle.

ECBC also provided extensive technology development support to the Joint Program Executive Office in 2005. That support included:

- Developing a new high-temperature storage program for Improved Chemical Agent Monitors currently fielded in extreme desert heat
- Providing a candidate decontamination technology for sensitive equipment and interior decontamination applications
- Launching an intensive engineering sustainment effort for the M21 remote sensing chemical agent alarm, which is being deployed well beyond its intended service life
- Adding a new capability to the M256A1 so it can detect low volatility hazards
- Developing an air sample collector efficient at the 1 micron particle size
- Conducting a down-select process to identify the most appropriate analytical equipment for the National Guard Civil Support Teams' Analytical Laboratory System

The Joint Program Executive Office for Chemical and Biological Defense executes a critically important mission for the warfighter. ECBC plays a key role in ensuring its customer has the hands-on expertise, trained personnel and unique facilities necessary for providing the warfighter the world's most effective chemical and biological defense equipment.

TACOM Integrated Logistics Support Center

TACOM's LifeCycle Management Command's Integrated Logistics Support Center, headquartered at the Detroit Arsenal, is responsible for ensuring warfighter readiness by managing sustainment activities for ground combat troops.

During 2005, ECBC was engaged in a wide variety of engineering and technical sustainment support activities for TACOM. This support included: providing engineering design, configuration management, laboratory testing and technical data for purchases of spare parts and consumable items; reverse engineering; software engineering and quality assurance activities. ECBC also verified the serviceability of chemical and biological defense equipment through shelf life testing and technical assessments.

A significant accomplishment in 2005 was the inspection and testing of 368 Improved Chemical Agent Monitors at Fort Hood, Texas. This was completed as part of the military's "RESET" program to return the equipment to optimal condition. Specifically, a problem was found with the depletion of the acetone source and system contamination from off-gassing of internal polymeric seals. These system deficiencies were investigated and corrective actions were initiated. In addition, quality issues were resolved, engineering input to procurement packages was provided and a solicitation developed.

In 2006, ECBC will continue to provide a wide breadth of technical expertise for support to the items currently in the TACOM inventory and those that will be added throughout 2006. In partnership, ECBC is helping TACOM provide maximum equipment readiness and availability to the warfighter.

Chemical Materials Agency

In 1997, the United States ratified its support for the Chemical Weapons Convention, an international treaty that prohibits the development, production, stockpile, transfer and use of chemical weapons. The treaty also calls for the destruction of all chemical weapons stockpiles around the world. The Chemical Materials Agency is the organization responsible for carrying out this mission in the United States.

ECBC has provided engineering support and trained operational personnel to the chemical demilitarization program since its inception in the late 1960s. In recent years, ECBC collaborated with Sandia National Laboratories and the Chemical Materials Agency to develop two generations of the Explosive Destruction System for safe on-site chemical agent containment during detonation of non-stockpile munitions. Detonation and then chemical neutralization take place in a sealed, stainless steel chamber that contains all of the blast, vapor, and fragments from the munitions. Since 1999, the system has been used in successful chemical munitions destruction at sites such as Aberdeen Proving Ground, Maryland and Spring Valley in Washington, D.C. In 2005, ECBC personnel deployed the system to Dover Air Force Base twice to neutralize two World War I-era mustard-filled chemical munitions that had been discovered while dredging for clams. ECBC expects to go back to Dover to neutralize additional munitions in 2006.

Also in 2005, ECBC performed testing on the second version of the Explosive Destruction System, which allows it to neutralize six munitions at one time instead of a single munition. This higher-throughput system will be used in 2006 at Pine Bluff Arsenal to destroy 1,200 munitions at that arsenal over the next 18 months. Approximately 40 ECBC personnel are stationed at Pine Bluff Arsenal for this project and other future missions.

ECBC staff helped complete demilitarization operations at Aberdeen Chemical Disposal Facility in 2005, one of the eight stockpile storage sites in the continental United States. This was a significant milestone for the Chemical Materials Agency, as the Aberdeen stockpile site was the first in the continental United States to completely destroy its stockpile. ECBC supported the design and operation of the facility, and provided 24 technicians on-site for three years. In February 2005, stockpile operations were concluded and ECBC began closing activities for the site, which include disposal of solid material and hydrolosate.

20th Support Command

The 20th Support Command was established in 2004 to consolidate the Army's chemical, biological, radiological, nuclear and explosive response capability in one organization. The Command's mission is to train, integrate, coordinate, deploy, and manage the U.S. Army Forces Command technical assets in this area. This mission includes working collaboratively with other response units and partnering with research and development organizations in other parts of the Department of Defense so that 20th Support Command personnel have the most capable equipment.

In 2005, ECBC designed, built and delivered a chemical mobile laboratory system and a biological mobile laboratory system for the 20th Support Command. These laboratory systems' unique design incorporates advanced safety, engineering and quality control systems to allow rapid high quality sample collection and analysis. ECBC also designed specific protocols and methodologies and trained 20th Support Command laboratory personnel on their use so the Command could deploy immediately to sites in the United States and abroad.

Similar to the support provided to its other military and domestic mobile laboratory customers, ECBC extended access for the 20th Support Command to ECBC's fixed-site laboratory for technical assistance and confirmation of results during deployments or missions. In 2006, ECBC will continue to provide consultation and support in the areas of engineering, product improvement, analysis and detection of chemical and biological materials.

Homeland Security Community

Many federal agencies were not concerned with chemical or biological preparedness prior to 9-11. Since that time, however, nearly all government agencies have acquired some responsibility in strengthening our nation's security against weapons of mass destruction. ECBC's support to the homeland security community has grown accordingly, and includes interagency partnerships with almost every federal agency. In response to this urgent civilian need for chemical and biological expertise, ECBC has evolved into a national resource that is providing preparedness solutions for the warfighter as well as for the domestic response community.

In 2005, ECBC expanded its work with the Department of Homeland Security. A memorandum of understanding between the Departments of Defense and Homeland Security was signed in December 2005 to establish the Chemical Security Analysis Center at Edgewood. In conjunction with the US Army Medical Research Institute for Chemical Defense and the Center for Health Promotion and Preventive Medicine, ECBC will be providing research and development support, which includes characterizing current and emerging threats; generating physical, chemical and toxicological information for developing risk assessments; identifying knowledge gaps; refining methodology for conducting forensic analysis of evidence from acts of chemical terrorism; and providing reach-back expertise in the area of chemical defense.

Other work conducted by ECBC for the Department of Homeland Security in 2005 included performing quantitative performance testing of biological detection systems for the Department of Homeland Security's BioWatch program, an early warning system of detectors placed in major urban areas nationwide that can rapidly detect trace amounts of biological materials in the air. ECBC also developed a test bed to validate the performance of experimental and developmental systems that will become future BioWatch technologies.

ECBC and the Environment Protection Agency's Office of Research and Development National Homeland Security Research Center continued collaborative research efforts, which began in 2002. Of particular note in 2005 were projects to study the fate of toxins —such as ricin—in water, efficacy testing of vaporous hydrogen peroxide on indoor building materials contaminated with biological agents, development of a database on chemical and biological agents for use by the Environmental Protection Agency and emergency responders, studies to optimize ricin decontamination methods, and development and verification of response protocols for detection of biological agents in drinking water.

ECBC also continued a long-standing relationship with the Federal Bureau of Investigations as its forensics laboratory for samples and analysis of contaminated evidence. In 2005, an arrangement to design and build an Evidence Handling and Storage Facility as part of the new ECBC Sample Receipt Facility was formalized.

For the United States Postal Service in 2005, ECBC conducted extensive aerosol science studies to understand how contaminants might be dispersed by post office equipment. These studies led to the redesign of post office mail sorting equipment and collaboration with Northrop Grumman to install over 1,000 systems in postal processing centers nationwide. In 2006, ECBC and Northrop Grumman will continue testing and modification of these systems to further improve their bio-collection and agent identification capabilities.

ECBC delivered a suite of mobile laboratories in late 2004 to the Food and Drug Administration for use at ports of entry for food and pharmaceuticals coming into the country. These laboratories were deployed in 2005 to Louisiana to assist in the wake of Hurricane Katrina. The labs are being used to conduct testing of fisheries to ensure the food supply is safe. ECBC also deployed specialists to set up the mobile laboratories to supplement the Food and Drug Administration's efforts in the Gulf Coast region.

Private Sector Partnerships

The private sector plays an important role in advancing chemical and biological defense technologies. ECBC's task as a government laboratory is to enable the private sector—industry—to better support the warfighter and homeland security. ECBC does this by sharing its knowledge and expertise accumulated from working with chemical and biological materials. In 2005, ECBC partnered with 49 firms under cooperative research and development agreements, which resulted in an infusion of ideas and knowledge that benefited the warfighter. Similarly, much of the research and development conducted to meet specific warfighter requirements can be used by the private sector to address homeland security concerns.

In 2005, Genencor International, a leading biotechnology firm, began production of its new product DEFENZ, which is an enzyme-based technology that safely detoxifies nerve agents and organophosphorus pesticides. The product can be mixed with fire-fighting foams and sprays—adding additional capability to materials already in use in the first responder community and on the battlefield. This technology was first developed at ECBC for warfighter use and was licensed for marketing and manufacture to Genencor in 2004.

Another decontamination technology, Modified Vaporous Hydrogen Peroxide, began as a medical equipment sterilant. Originally developed by STERIS Inc., this technology was widely used in hospitals and medical centers. Under a collaborative research agreement, ECBC scientists worked with STERIS to modify the technology to be an effective chemical decontaminant as well. In 2005, ECBC conducted demonstrations of this technology on military aircraft and on vehicles, including civilian ambulances. Modified Vaporous Hydrogen Peroxide is planned to be part of the Joint Program Executive Officer's decontamination program in 2007.

There are other numerous examples of how, in 2005, the private sector collaborated with ECBC to help the military advance its science and technology objectives. Some of these include:

- Guild Associates, a firm in Cincinnati, Ohio, collaborated with ECBC to develop new filtration material for use in masks and large air purification systems
- Physical Science, Inc., worked with ECBC to design and demonstrate a real-time high resolution aerial imaging and detection capability that can be installed in unmanned aerial vehicles and helicopters to "see" chemicals released near the ground
- 20/20 Gene Systems and ECBC partnered on a technology that allows the use of a hair follicle to identify and validate bio-markers indicative of exposure to low-level chemical warfare agents, an approach which may lead to a new rapid diagnostic field test

Through such partnerships, ECBC is sharing its 90 years of experience working with chemical and biological agents with the private sector to the benefit of the warfighter and the homeland.

Community and Volunteerism

This year ECBC employees were generous with their time and talents, reaching out to local students and families in the communities near Aberdeen Proving Ground.

In 2005, ECBC scientists helped administrators of the new Science and Mathematics Academy at Aberdeen High School refine their curriculum and provided expertise to teachers and students. The academy, which enrolled its first class in September 2004, provides gifted high school students the opportunity to experience challenging coursework in science, mathematics and technology with an emphasis on real world application. ECBC serves as a co-chair of the academy's advisory board and in 2005, helped guide curriculum content, served as an informational resource for teachers and assisted in creating the Program for Academic and Career Exploration, which places students with scientist mentors at Aberdeen Proving Ground. ECBC also hosted a visit to Edgewood for 48 sophomores enrolled in the program, and toured the students through ECBC's new Advanced Chemistry Laboratory, the McNamara Life Sciences Facility and the Berger Engineering Laboratory where they had hands-on experiences in the prototyping lab, computer-aided design facility and robotics lab.

As part of the Kids and Chemistry program, ECBC staff members conduct science activities with local public school students. In 2005, 14 volunteer scientists worked with nearly 100 local fifth-graders, leading in-classroom experiments that explored chemical reactions using polymers and demonstrated how changes in pH and temperature affect the rate of a chemical reaction. Ten ECBC volunteer scientists participated in National Chemistry Week at the Edgewood and Bel Air public libraries, conducting interactive experiments relating chemistry to toys with over 100 participants, some as young as six years old. Kids and Chemistry volunteers also participated in ECBC's organization day and made a visit to Eden Mill Nature Center to share science with a group of students learning about environmental chemistry. In total, ECBC scientists worked closely with over 250 local students, sharing their passion for the field of science.

In May 2005, ECBC was selected to serve on the Harford County Program Advisory Committee for the development of a first-in-the-nation high school curriculum in Homeland Security and Emergency Preparedness, a program that will be piloted at Joppatowne High School in Joppa, Maryland. ECBC helped conduct a needs assessment, establish the Homeland Security Sciences Program Sequence and identified courses of instruction that would be taught under this sequence. ECBC also helped obtain program approval and secure funding for this pioneering effort. Because of its involvement in this program, ECBC was also selected to serve on a Maryland State Department of Education advisory council and invited to participate at the national level working with the Department of Education.

For over eight years, ECBC engineers have participated in the Volunteers for Medical Engineering program to improve the independence of individuals with disabilities through innovative engineering. In 2005, employees worked on projects including the design of a brake system for an office chair; shower chair modifications and a wheelchair drive system and prosthetic devices. An ECBC engineer won an award for his work with a wheelchair-bound expectant mother in 2005.

APG Civilian Volunteer of the Year

Larry Oswald was chosen as the 2005 APG Civilian Volunteer of the Year. He donated his time and talents on the modification of a baby crib for a wheelchair-restricted expectant mother, which enabled her to more easily care for her newborn child. Oswald has been working with the Volunteers for Medical Engineering program for over ten years.